Christoph Heindl

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▬▬▬ Summary

I am currently a research scientist at PROFACTOR and until recently I was a doctoral candidate in the Computational Perception group at the Johannes Kepler University of Linz (JKU). I work at the interface of computer vision and robotics with a focus on probabilistic approaches to create optimized training data for machine learning. Recently, I created a widely used real-time 3D reconstruction software called ReconstructMe[1] and initiated several popular open source projects[2]. Both projects are now used by a variety of research groups worldwide, including Facebook, Google, and Microsoft.

Interests. Machine Learning, Computer Vision, and Robotics.

▬▬▬ Education

2016–2020 **Dr. techn. (with distinction)**, *JKU*, Linz, Computational Perception.
Visual Perception and Interaction Using Synthetic Data in Manufacturing.

2000–2004 **DI(FH)**, *FH Upper Austria*, Hagenberg, Software Engineering.
Pairwise Registration of 3-D Range Data: Analysis and Evaluation of Modern Algorithms

▬▬▬ Experience

My professional work experience as a full-time researcher.

2016–now **Scientist**, *PROFACTOR GmbH*, Steyr.
Machine Learning for Visual Computing

2008–2016 **Senior Research Engineer**, *PROFACTOR GmbH*, Steyr.
Robotics and Adapative Systems

2004–2008 **Research Engineer**, *PROFACTOR GmbH*, Steyr.
3D Computer Vision

▬▬▬ Research Projects

A selection of research projects that I have worked on in the past and for which I partly helped to secure funding.

2019–2023 **Medusa**, *Innovatives OÖ 2020*, 2.000.000€.
Leitprojekt Medizintechnik: Creation of an innovative training and planning platform for neurosurgeons with vision-based behavior documentation.

2017–2021 **Lern4MRK**, *BMVIT*, 2.000.000€.
Learn to map human demonstrations onto collaborative robots.

2015–2018 **Autoscan**, *FFG*, 1.300.000€.
An autonomous sensor system utilizes human activity forecasting for active thermography planning.

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[1] https://www.reconstructme.net/
[2] https://github.com/cheind

2015–2017 **SIAM**, *FFG*, 730.000€.
Seamless interoperability of assistive modules in the digital factory for automated 3D documentation.

2013-2017 **NextFactory**, *ICT*, 4.760.000€.
All-in-one manufacturing platform for system in package and micromechatronic systems.

2012–2014 **ShowMe**, *FFG*, 560.000€.
Assistive system for assembly tasks based spatially correct projections and next step recommendations.

2010–2013 **SRS**, *ICT*, 5.000.000€.
Semi-autonomous robotic solutions in domestic environments for elderly people support.

2008–2010 **AHUMARI**, *FFG*, 400.000€.
Fusing robot programming by demonstration with visual tracking.

Awards

2021 Best Demo Honorable Mention (Ubicomp2021)

2018 2nd place in the classification of acoustic scenes (DCASE2018)

2017 Best oral presentation (ICMV2017)

2012 enGenius award for our Binpicking system iRobFeeder (BMW)

2007 Hagenberg Software Award

2006 State Award for Innovation (Landespreis für Innovation)

Patents

2020 Calibration method for a projector - Kalibrierverfahren für einen Projektor (AT522320)

2017 Apparatus for detecting a three-dimensional model corresponding to the surface of an object - Vorrichtung zum Erfassen eines der Oberfläche eines Objektes entsprechenden dreidimensionalen Modells (AT519447B1)

2009 Method for continuously determining a gripping position (WO2011003124A1)

Miscellaneous

2019 Host of Workshop (OAGM2019)

2019 Reviewer (IJCAI2019, ICRA2021), Session chair (ETFA2019)

2017–2020 Supervised three master students

Publications

[3] **Christoph Heindl**, Lukas Brunner, Sebastian Zambal, and Josef Scharinger. "BlendTorch: A Real-Time, Adaptive Domain Randomization Library". In: *1st Workshop on Industrial Machine Learning at International Conference on Pattern Recognition (ICPR2020)*. Milan, Italy: Springer, 2021.

[4] Thomas Pönitz, Gerhard Ebenhofer, Gernot Stübl, **Christoph Heindl**, and Josef Scharinger. "On the Potential of large-scale Extended Reality Interaction for Industrial Environments". In: *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2021 ACM International Symposium on Wearable Computers*. Best Demo Honorable Mention. Virtual Conference: ACM, 2021.

[9] **Christoph Heindl**, Markus Ikeda, Gernot Stübl, Andreas Pichler, and Josef Scharinger. "Enhanced Human-Machine Interaction by Combining Proximity Sensing with Global Per-

ception". In: *2nd Workshop on Proximity Perception in Robotics at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. KITopen, 2019.

[12] **Christoph Heindl**, Gernot Stübl, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. "Visual Large-scale Industrial Interaction Processing". In: *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2019 ACM International Symposium on Wearable Computers*. London, United Kingdom: ACM, 2019, pp. 280–283. ISBN: 978-1-4503-6869-8.

[13] **Christoph Heindl**, Sebastian Zambal, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. "3D Robot Pose Estimation from 2D Images". In: *Proceedings of the International Conference on Digital Image & Signal Processing (DISP)*. Corgascience Oxford, 2019. ISBN: 978-1-912532-05-6.

[14] **Christoph Heindl**, Sebastian Zambal, and Josef Scharinger. "Learning to Predict Robot Keypoints Using Artificially Generated Images". In: *24th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)*. IEEE, 2019, pp. 1536–1539. ISBN: 978-1-7281-0303-7.

[16] Thomas Pönitz, **Christoph Heindl**, Andreas Pichler, and Martin Kampel. "Automatic Intrinsics and Extrinsics Projector Calibration with Embedded Light Sensors". In: *Proceedings of the Joint ARW & OAGM Workshop 2019*. OAGM & GMAR. Verlag der Technischen Universität Graz, 2019, pp. 193–194. ISBN: 978-3-85125-663-5.

[17] Sebastian Zambal, **Christoph Heindl**, and Christian Eitzinger. "Machine Learning for CFRP Quality Control". In: *Conference of the Society for the Advancement of Material and Process Engineering (SAMPE)*. Nantes, France: SAMPE, 2019.

[18] Sebastian Zambal, **Christoph Heindl**, and Christian Eitzinger. "Probabilistic Modelling combined with a CNN for boundary detection of carbon fiber fabrics". In: *IEEE 17th International Conference on Industrial Informatics (INDIN)*. IEEE, 2019, pp. 1621–1626. ISBN: 978-1-7281-2927-3.

[19] Sebastian Zambal, **Christoph Heindl**, Christian Eitzinger, and Josef Scharinger. "End-to-end defect detection in automated fiber placement based on artificially generated data". In: *Fourteenth International Conference on Quality Control by Artificial Vision*. International Society for Optics and Photonics. SPIE, 2019, pp. 371–378. ISBN: 978-1-5106-3054-3.

[23] **Christoph Heindl**, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. "Large Area 3D Human Pose Detection Via Stereo Reconstruction in Panoramic Cameras". In: *Proceedings of the OAGM Workshop*. Austrian Association of Pattern Recognition. Verlag der Technischen Universität Graz, 2018, pp. 103–110.

[26] **Christoph Heindl**, Thomas Pönitz, Gernot Stübl, Andreas Pichler, and Josef Scharinger. "Spatio-thermal depth correction of RGB-D sensors based on Gaussian processes in real-time". In: *Tenth International Conference on Machine Vision (ICMV)*. Vol. 10696. International Society for Optics and Photonics. SPIE, 2018, pp. 333–340.

[28] Gernot Stübl, **Christoph Heindl**, Harald Bauer, and Andreas Pichler. "On Quality Assurance of 3D Bust Reconstructions". In: *Proceedings of the 2nd OAGM-ARW Joint Workshop Vision, Automation and Robotics*. 2017.

[29] Sharath C. Akkaladevi, Martin Ankerl, **Christoph Heindl**, and Andreas Pichler. "Tracking multiple rigid symmetric and non-symmetric objects in real-time using depth data". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2016, pp. 5644–5649. ISBN: 978-1-4673-8026-3.

[32] **Christoph Heindl**, Sharath C. Akkaladevi, and Harald Bauer. "Capturing Photorealistic and Printable 3D Models Using Low-Cost Hardware". In: *Advances in Visual Computing*. Springer International Publishing, 2016, pp. 507–518. ISBN: 978-3-319-50835-1.

[33] Sharath C. Akkaladevi and **Christoph Heindl**. "Action Recognition for Human Robot Interaction in Industrial Applications". In: *IEEE International Conference on Computer Graphics, Vision and Information Security (CGVIS)*. 2015, pp. 94–99. ISBN: 978-1-4673-7437-8.

[34] **Christoph Heindl**, Harald Bauer, Martin Ankerl, and Andreas Pichler. "ReconstructMe SDK: a C API for Real-time 3D Scanning". In: *6th International Conference and Exhibition on 3D Body Scanning Technologies*. 2015. ISBN: 978-3-033-05270-3.

Technical Reports and Posters

[1] **Christoph Heindl**. *Monte Carlo Integration*. Aug. 2022. URL: `https://doi.org/10.5281/zenodo.7013396`.

[2] **Christoph Heindl**. *py-microdots and the Anoto Codec*. See https://github.com/cheind/py-microdots for additional information. Aug. 2022. URL: `https://doi.org/10.5281/zenodo.7009235`.

[5] **Christoph Heindl**. *Graph Neural Networks for Node-Level Predictions*. 2020. arXiv: `2007.08649 [cs.LG]`.

[10] **Christoph Heindl**, Markus Ikeda, Gernot Stübl, Andreas Pichler, and Josef Scharinger. *Metric Pose Estimation for Human-Machine Interaction Using Monocular Vision*. Poster at Workshop on Factory of the Future at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). 2019.

[11] **Christoph Heindl** and Josef Scharinger. *Notes on Semi-Supervised Expectation Maximization*. 2019. URL: `https://doi.org/10.5281/zenodo.3484301`.

[20] Matthias Dorfer, Bernhard Lehner, Hamid Eghbal-zadeh, **Christoph Heindl**, Fabian Paischer, and Gerhard Widmer. *Acoustic Scene Classification with Fully Convolutional Neural Networks and I-Vectors*. 2018.